REMARKS

This Amendment is filed in response to the February 7, 2006 Office action that was issued in connection with the above-identified patent application.

Claims 36-66 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over various references cited by the Examiner. Applicants respectfully traverse these rejections in view of the above amendments and the following remarks.

Claims 36, 38-40, 44 and 54.

Claims 36, 38-40, 44 and 54 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent No. 4,401,052 to Baron et al. ("Baron") in view of U.S. Patent No. 5,053,355 to vonCampe ("vonCampe") or U.S. Patent No. 4,844,719 to Toyomoto et al. ("Toyomoto et al.") and further in view of U.S. Patent No. 5,741,547 to Akram et al. ("Akram") or U.S. Patent No. 6,074,487 to Yosioka et al. ("Yosioka").

Combining the cited references does not establish that the rejected claims are *prima facie* obvious. First, neither Akram or Yosioka is analogous art with regard to Baron or Applicants' claims (I). Second, combining the references as proposed by the Examiner does not disclose each feature of the claims (II). Third, one skilled in the art would not be motivated to combine Baron with Akram or Yosioka (III). Fourth, the proposed modification of Baron would render it unsatisfactory for its intended purpose (IV). Finally, the proposed modification of Baron changes its principle of operation (V).

I. The Cited References Include Non-Analogous Art

Applicants submit that it is improper to cite Akram and Yoshioka under 35 U.S.C. § 103(a) because those references are not analogous to the claimed invention.

Applicants contend that the references disclosing CVD methods are insufficient to maintain an obviousness rejection for claims directed to PVD methods.

1. Differences between PVD and CVD methods in general.

Physical vapor deposition ("PVD") and chemical vapor deposition ("CVD") are markedly different deposition methods employed for different purposes. As is well known by those skilled in the art, a PVD method involves vaporizing a source material by physical means, transporting the vapor to a substrate, and depositing the source material itself on the substrate by condensation (under low pressure). Claim 36 recites a PVD system, but two of the five cited references, Akram and Yosioka, disclose CVD methods and apparatus.

In contrast to PVD, CVD involves reacting source materials together to produce an entirely new reaction product that is deposited on the substrate. A CVD method introduces a mixture of reactive source materials on or near the substrate, reacts the source materials together to produce a reaction product, deposits the reaction product onto the substrate, and removes any byproducts and unreacted source materials. A major distinction between PVD and CVD methods is that with a PVD method, it is the source material itself that is deposited on a substrate whereas with a CVD method it is a reaction product distinct from the source material that is deposited on the substrate. In fact, with CVD the source material itself is typically removed as an impurity.

Thus, one skilled in the art would understand that references such as Akram and Yosioka disclosing CVD methods are non-analogous art with respect to a PVD method as claimed.

2. *Different Fields of Endeavor*

Akram or Yosioka are not analogous art because they are not within the same field of endeavor.

Akram and Yosioka are not analogous to applicants' claimed invention because they disclose CVD methods and apparatus for manufacturing semiconductor and integrated circuits. Applicants' application relates to an entirely different field of endeavor, PVD systems for manufacturing solar cells. To ensure solar conversion efficiency, solar cells require different properties than needed for semiconductor or integrated circuits, such as a relatively smooth surface and a surface with a homogonous composition.

3. *The cited references are not reasonably pertinent to the PVD problems addressed.*

Further, neither Akram or Yoshioka is analogous art because they are not reasonably pertinent to the problems addressed in the present application. Disclosures relating to CVD methods and apparatus to manufacture integrated circuits or semiconductors are not reasonably pertinent to the problems addressed by this application. For example, Akram and Yoshioka are not reasonably pertinent to producing complex multi-element solar cell films using PVD sputtering or evaporation techniques.

Additionally, Akram and Yoshioka are not reasonably pertinent to PVD techniques for producing overlapping plumes of different source material vapors in the same deposition chamber as a means to control the source material deposited on a substrate. In PVD applications, low pressure is used to achieve the compositions

desired because it allows the plumes to mix freely; however, CVD methods operate at high pressures to ensure that the reactive gases arrive at the substrate simultaneously. One skilled in the art would know that the high pressures used by CVD methods inhibit the mixing achieved in Applicants' PVD system.

Accordingly, Akram and Yoshioka are non-analogous art with regard to Baron or the subject matter recited in the claims.

II. Combining the Cited References Does Not Disclose Each Element Recited in Claim 36

Combining the cited references does not disclose a PVD system with two vessels in the same deposition zone having different source materials. The Examiner acknowledges that Baron does not disclose this feature, but suggests that the first and second vessels could concurrently emit different source materials. Akram and Yoshioka are cited to allegedly show that it is well known "to provide two different source materials that are combined to create a concurrently emitted reactant mixture." However, as discussed above, Akram and Yoshioka disclose *CVD* systems that operate under wholly different principles than the recited *PVD* system.

Highlighting the difference between PVD and CVD methods is the Examiner's use of the language "reactant mixture." While reactant mixtures are applicable to CVD systems, PVD systems do not react source materials together, but instead deposit the source materials directly onto a substrate. Applicants do not dispute that it is well known in the art to concurrently emit different reactants in a CVD system. However, there is no teaching or suggestion of a reason or motivation why a person would

attempt to emit different source materials into overlapping plumes in the same deposition chamber in a PVD process.

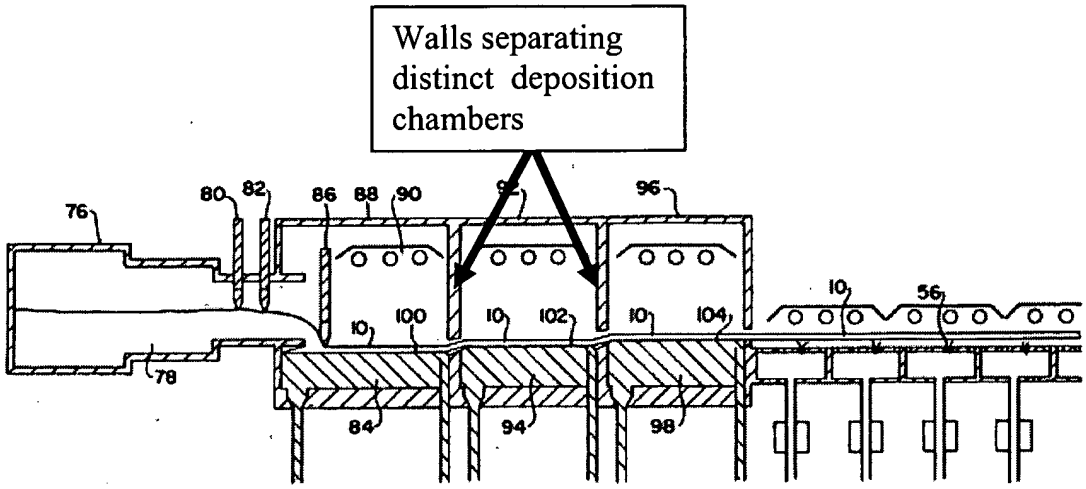
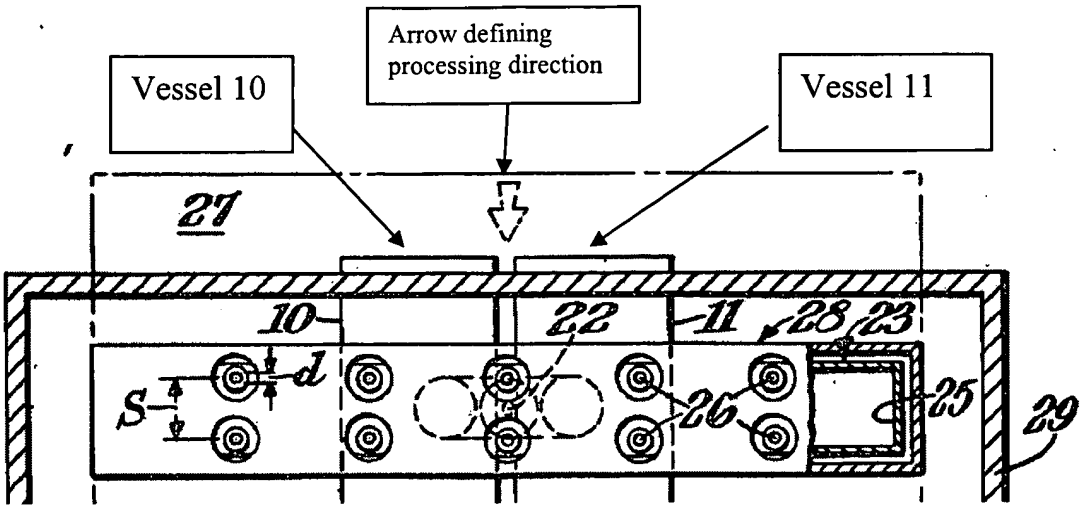


FIG. 3

The PVD references cited by the Examiner bear out Applicants' position that prior PVD systems operate by isolating different source materials instead of emitting them concurrently, particularly overlapping different materials in the same chamber. For example, the vonCampe system (a PVD system), shown above, isolates different source materials into separate deposition chambers. Cross contamination of source materials between the deposition chambers is avoided by using dividing walls.



Further, the Baron first and second vessels are not located serially along the processing path. To the contrary, as shown above in the partial view of Baron Fig. 2, vessel 10 and vessel 11 are parallel to each other along the processing path. Because claim 36 recites first and second substantially closed vessels located serially along the processing path, Baron modified to contain different source materials in vessels 10 and 11 as proposed by the Examiner would still not disclose each feature of claim 36.

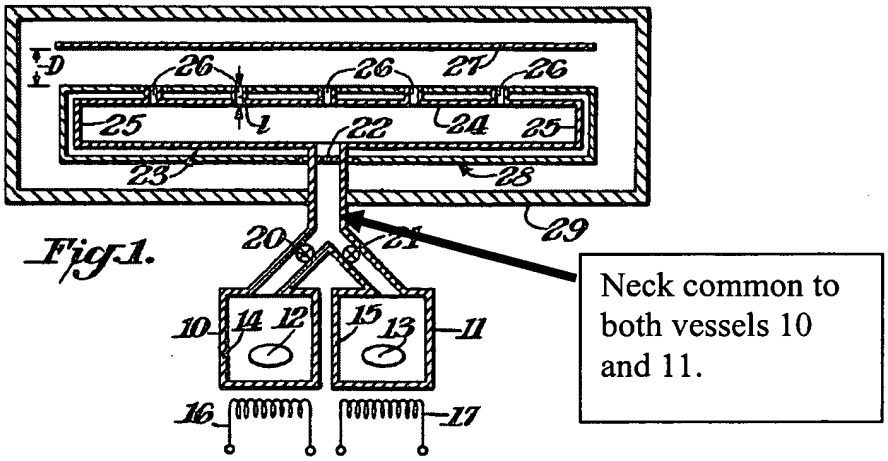


Fig. 1.

Moreover, combining the cited references does not disclose a PVD system having a fog with a substantially uniform composition across the width of the PVD zone and a varying composition across the length of the PVD zone. Even if a PVD reference suggested placing different source materials in the first and second vessels (10,11) of

Baron, shown above, such a system would still not disclose Applicants' PVD system recited in claim 36. If different source materials were placed in vessels 10 and 11, they would combine and mix together into a substantially uniform composition in the shared neck prior to passing through the common orifice 22. Contrary to claim 36, which recites a fog with a *varying* composition along the length of the PVD zone, modifying Baron as proposed by the Examiner would result in a fog with a substantially *uniform* composition about both the length and width of the PVD zone.

Combining the references does not disclose a system wherein different source materials are deposited onto a strip material in a physical vapor deposition zone. While Baron discloses depositing a single source material, neither combining Baron with Akram or with Yoshioka discloses depositing another *source material*. Instead, adding Akram or Yoshioka would result in the deposition of a *reaction product* onto a strip material. Because a reaction product is not a source material as recited in claim 36, combining the references does not disclose this feature.

For at least these reasons, combining the cited references fails to disclose each feature recited in claim 36. Accordingly, the cited references also fail to disclose each feature of claims 38-40, 44, and 54 depending from claim 36 and incorporating its elements therein. Therefore, the cited references do not establish that the rejected claims are *prima facie* obvious under 35 U.S.C. § 103(a).

III. No Motivation to Combine the References

One skilled in the art would not be motivated to combine Baron with Akram or Yosioka because of the numerous incompatibilities between PVD and CVD methods.

First, one skilled in the art would not be motivated to combine the references because CVD methods (including Akram, Yoshioka) impart properties onto a substrate that are undesirable for a solar cell. Baron discloses a PVD apparatus for manufacturing thin film solar cells whereas Akram and Yosioka disclose CVD methods and apparatus for manufacturing semiconductor and integrated circuits. The disclosed CVD methods increase the coating surface roughness, which is detrimental to solar conversion efficiency. Moreover, CVD methods cause compositional inhomogeneities that act as electronic defects, which further degrades solar cell performance.

Second, one skilled in the art would not be motivated to combine the references because PVD and CVD methods operate at significantly different pressures. CVD methods require substantially higher pressures than PVD methods to ensure the reactive gases have sufficient residence time on the substrate for heating and reaction. On the other hand, PVD methods operate at lower pressures to facilitate directional emission and a long mean-free-path between molecular collisions. CVD methods typically require pressures greater than 10^{-3} Torr whereas PVD methods typically operate below 10^{-4} Torr. Thus, the operating pressures used in CVD and PVD typically differ by at least an order of magnitude.

IV. Modifying Baron as proposed would render it unsatisfactory for its intended purpose.

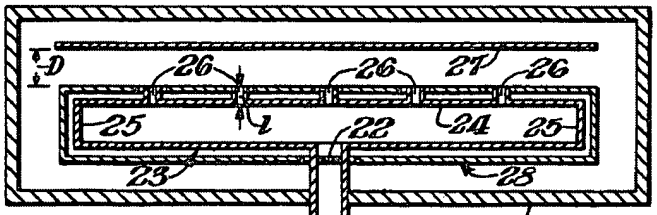


Fig. 1.

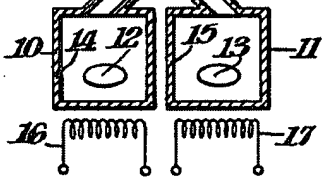


Fig. 2.

A first intended purpose of Baron is to provide a reserve of source material to avoid process downtime. Baron addresses the problem of needing to break system vacuum to replenish depleted source material in single vessel systems. Baron achieves "an apparatus for continuous deposition" by providing a back-up vessel 11 containing the same source material as contained in vessel 10. Modifying Baron to include a different material in vessel 11 than included in vessel 10 would defeat its intended purpose because the process would have to stop and break vacuum to replenish the vessels when either ran empty. Thus, contrary to its intended purpose, Baron would become a batch process instead of a continuous process.

A second intended purpose of Baron is to provide an apparatus that operates in an uncomplicated and inexpensive manner. In fact, Baron states that the "control of evaporation rate from a multiplicity of crucibles by maintaining the temperatures of each crucible is difficult and costly." However, the proposed modification would require that Baron undertake such difficult and costly measures by including different source materials in vessels 10 and 11, splitting the single delivery channel into two, and

reorienting the vessels serially relative to the processing path. To operate the Baron apparatus as modified, one would have to control the evaporation rate from multiple crucibles, namely, vessels 10 and 11, by maintaining them at different temperatures. Accordingly, operating Baron in this manner would run contrary to Baron's intended purpose of simple and cost effective operation.

V. Modifying Baron as Proposed Changes its Principle of Operation.

The proposed modification of Baron changes its principle of operation from a continuous processing apparatus to a batch processing apparatus, directly contrary to Baron's stated purpose. Baron operates by evaporating a single source material from a single heated chamber 10 into a deposition zone through an open valve 20. An initially unheated chamber 11 containing the same source material serves as a back-up and is isolated from the deposition zone by closed valve 21. Only upon exhaustion of the source material from chamber 10 is back-up chamber 11 heated to evaporate that same source material and is valve 21 opened. The proposed modification would require that Baron concurrently heat both chambers 10 and 11 and keep both valves 20 and 21 concurrently open. Operating in this manner, Baron would no longer have backup chambers of source material, which in effect would transform the Baron process back to a batch process contrary to its continuous process principle of operation.

Claims 56-66.

Claims 56-66 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Baron in view of vonCampe or Toyomoto and in view of Akram or Yoshioka and Chow in further view of U.S. Patent No. 5,571,749 to Matsuda et al. ("Matsuda").

For reasons analogous to those previously presented regarding claim 36, combining Baron, vonCampe or Toyomoto, and Akram or Yoshioka, Chow, and Matsuda does not establish a *prima facie* case for obviousness of claim 56. CVD references Akram and Yoshioka are no more analogous to the claim 56 PVD system than they were to the claim 36 PVD system. Similarly, one skilled in the art would have no more motivation to combine CVD references with the claim 56 PVD system than one would have with claim 36.

In addition, combining the cited references fails to disclose each feature of claim 56. For example, the proposed combination does not disclose first and second crucibles arranged serially along the processing path. Further, combining the references does not show a PVD system with first and second crucibles concurrently emitting different source materials. Another deficiency of the proposed combination is that it does not disclose overlapping plumes of different source materials. Lacking disclosure of these and other elements of claim 56, the cited references do not establish a *prima facie* case that claim 56 is obvious.

Accordingly, combining Baron, Akram or Yoshioka, Chow, and Matsuda does not establish a *prima facie* case that claim 56 is obvious under 35 U.S.C. § 103(a). It then

follows that claims 57-66 depending from claim 56 are similarly not obvious. Applicants, therefore, request allowance of claims 56-66.

Conclusion

Applicants have responded to all of the issues raised in the Office action. If there are any questions regarding this paper, or the application as a whole, the Examiner is encouraged to contact the undersigned attorney so that allowance of the claims may be facilitated.

CERTIFICATE OF MAILING

I hereby certify that this correspondence is being deposited with the United States Postal Service as first class mail in an envelope addressed to: Mail Stop Amendment, Commissioner for Patents, P.O. Box 1450, Alexandria, Virginia 22313-1450 on August 7, 2006.

Suzanne Lukas-Werner

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